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TITLE: B-STAGE RESIN SHEET WITH DOUBLE-SURFACE TREATED COPPER FOIL SUITABLE FOR CARBON DIOXIDE LASER PERFORATION, AND PRINTED WIRING BOARD USING THE SAME

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ABSTRACT:

PROBLEM TO BE SOLVED: To obtain a B-stage resin sheet with a copper foil which can be perforated by the direct irradiation with carbon dioxide laser.

SOLUTION: A sheet wherein a B-stage resin layer, which is obtained by applying a polyfunctional cyanic ester resin composition preferably compounded with 10-80 pts.wt. of an inorganic insulating filler to the opposite surface of

a double-surface treated copper foil to which nickel treatment or nickel alloy treatment is preferably applied to dry the coating layer, is bonded on carbon dioxide laser irradiation side and the printed wiring board using this sheet are provided. The surface of the copper foil preferably subjected to nickel treatment or nickel alloy treatment of the copper clad sheet obtained using the sheet is directly irradiated with high output carbon dioxide laser of which the energy is preferably 10-60 mJ to process and remove outer and inner copper foil layers to form through-holes and/or blind viaholes with a pore size of 80-180

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(54)【発明の名称】　炭酸ガスレーザー孔あけに適した両面処理銅箔付きＢステージ樹脂シート及びそれを用いたプリント配線板。

(57)【要約】
【課題】　Ｂステージ樹脂付きシートで、炭酸ガスレーザーを直接照射して孔あけ可能な銅箔付きＢステージ樹脂シートを得る。
【解決手段】　炭酸ガスレーザー照射側には好適にはニッケル処理又はニッケル合金処理を施した両面処理銅箔の反対面に、好適には無機絶縁性充填剤を10～80重量部配合した多官能性シアン酸エステル樹脂組成物を塗布、乾燥して得られたＢステージ樹脂層を付着したシート、及び該シートを用いたプリント配線板を提供する。これを用いて得られた銅張板の、好適にはニッケル処理或いはニッケル合金処理された銅箔面の上から、好適には10～60mJより選ばれた高出力の炭酸ガスレーザーを直接照射することにより、外層及び内層銅箔を加工除去して孔径８０～１８０μmの貫通孔及び／又はブラインドビア孔を形成できる。その後、銅箔表裏表面及び内層銅箔に発生したバリ及び銅箔の表層の一部をエッチング除去して2～7μmとし、銅メッキを行って得られる銅張板を用いて高密度プリント配線板を作成する。
【効果】　直接炭酸ガスレーザーを照射して貫通孔及び／又はブラインドビア孔をあけることができる両面処理銅箔付きＢステージ樹脂シートを得ることができた。

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【特許請求の範囲】

【請求項1】　炭酸ガスレーザーエネルギー吸収の良い金属又は合金処理を銅箔マット面に施した両面処理銅箔のマット面に、Bステージの樹脂層を付着させたことを特徴とする両面処理銅箔付きBステージ樹脂シート。

【請求項2】　該両面処理銅箔の少なくともシャイニー面の銅箔面処理が、ニッケル金属処理又はニッケル合金処理であることを特徴とする請求項1記載の両面処理銅箔付きBステージ樹脂シート。

【請求項3】　該両面処理銅箔が、電解銅箔である請求項1又は2記載の両面処理銅箔付きBステージ樹脂シート。

【請求項4】　該両面処理銅箔付きBステージ樹脂シートが、連続シートであることを特徴とする請求項1、2又は3記載のBステージ樹脂シート。

【請求項5】　該Bステージ樹脂シートの樹脂が、多官能性シアン酸エステル、該シアン酸エステルプレポリマーを必須成分とする熱硬化性樹脂組成物であることを特徴とする請求項1，2、3又は4記載の両面処理銅箔付きBステージ樹脂シート。

【請求項6】　該熱硬化性樹脂組成物に絶縁性無機充填剤を10～80重量%配合したことを特徴とする請求項1，2，3、4又は5記載の両面処理銅箔付きBステージ樹脂シート。

【請求項7】　請求項1記載の両面処理銅箔付きBステージ樹脂シートを、内層板の少なくとも片面に配置し、加熱、加圧下に積層成形された銅張板の上から銅箔を孔あけ加工するに十分なエネルギーの炭酸ガスレーザーを直接照射して貫通孔及び／又はブラインドビア孔を形成して作成されることを特徴とするプリント配線板。

【請求項8】　請求項4記載の両面処理銅箔付き連続Bステージ樹脂シートを、内層板の少なくとも片面に配置し、連続的に加熱、加圧して接着させ、硬化して作成された銅張板の上から銅箔を孔あけ加工するに十分なエネルギーの炭酸ガスレーザーを直接照射して貫通孔及び／又はブラインドビア孔を形成して作成されることを特徴とするプリント配線板。

【請求項9】　炭酸ガスレーザーで孔あけ後、孔周辺に発生した銅箔バリを薬液で溶解除去すると同時に表層の銅箔の一部を溶解して作成されることを特徴とする請求項7又は8記載のプリント配線板。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、両面処理銅箔付きBステージ樹脂シート及びそれを用いて作成された銅張板に炭酸ガスレーザーで小径の孔をあけた高密度プリント配線板に関する。得られたプリント配線板は、小型、軽量の半導体プラスチックパッケージ、マザーボードプリント配線板などとして使用される。

【0002】

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【従来の技術】従来、半導体プラスチックパッケージ等に用いられる高密度のプリント配線板は、表層の銅箔は表面処理を施したものは使用されていなかった。又、孔あけ加工において、貫通孔はメカニカルドリルであけていた。近年、ますますドリルの径は小径となり、孔径が0.15mmφ以下となってきており、このような小径の孔をあける場合、ドリル径が細いため、孔あけ時にドリルが曲がる、折れる、加工速度が遅い等の欠点があり、生産性、信頼性等に問題のあるものであった。ブラインドビア孔は、事前に孔あけする位置の銅箔をエッチング除去してから、低エネルギーの炭酸ガスレーザーで孔を形成していた。この工程は、エッチングフィルムのラミネート接着、露光、現像、エッチング、フィルム剥離工程などが入るために時間を要し、作業性等に問題があった。

【0003】また、表裏の銅箔にあらかじめネガフィルムを使用して所定の方法で同じ大きさの孔をあけておき、更には内層の銅箔にも同様の孔を予めエッチングで形成したものを配置しておき、炭酸ガスレーザーで表裏を貫通する孔を形成しようとすると、内層銅箔の位置ズレ、孔と上下のランドとの間に隙間を生じ、接続不良、及び表裏のランドが形成できない等の欠点があった。更に近年ますます高密度化するプリント配線板において、耐熱性、耐マイグレーション性、吸湿後の絶縁性等が問題になってきている。

【0004】

【発明が解決しようとする課題】本発明は、以上の問題点を解決できるBステージ樹脂シート及び該樹脂シートを用いて作成した銅張板を用いたプリント配線板の提供を目的とする。

【0005】

【課題を解決するための手段】本発明は、両面処理銅箔のマット面にBステージの樹脂層を形成して得られるBステージ樹脂シート及びそれを用いて作成した銅張板を用いたプリント配線板を提供する。両面処理銅張付きBステージ樹脂シートを用いて積層成形するか連続的に張り合わせて銅張板とし、この銅張板に、好適には炭酸ガスレーザーで直接銅箔上にレーザービームを照射し、貫通孔及び／又はブラインドビア孔をあけてプリント配線板とすることにより、高密度のプリント配線板を作成することができる。

【0006】又、プリント配線板を作成する場合の孔あけにおいて、炭酸ガスレーザーを、好適にはニッケル金属処理或いはニッケル合金処理した銅箔面に直接照射することにより、貫通孔及び／又はブラインドビア孔を容易にあけることが可能であり、事前に銅箔をエッチング除去するなどの時間を節約できるとともに、高速で小径の孔が効率的に作成できる。炭酸ガスレーザーの出力において、好ましくは10～60mJから選ばれたエネルギーの炭酸ガスレーザーを直接銅箔の上から照射してスルーホール用貫通孔及び／又はブラインドビア孔を形成する。

加工後、孔部には銅箔のバリが発生する。機械的研磨でバリをとることもできるが、寸法変化等の点から、薬液によるエッチングが好適である。すなわち、孔あけ後に薬液を吹き付けるか、吸引して孔内を通し、表層の銅箔の一部をエッチング除去すると同時に銅箔バリをもエッチング除去する。

【0007】これを銅メッキでメッキアップして得られる両面銅張板を用い、表裏に回路形成を行い、定法にてプリント配線板とする。表裏の回路を細密にするためには、表裏層の銅箔を2～7μm、好ましくは3～5μmとする。この場合にはショートやパターン切れ等の不良の発生もなく、高密度のプリント配線板を作成することができる。更には、加工速度はドリルであける場合に比べて格段に速く、生産性も良好で、経済性にも優れているものが得られた。

【0008】又、多官能性シアン酸エステル、該シアン酸エステルプレポリマーを必須成分とする熱硬化性樹脂組成物を銅張板の絶縁層として使用するのが好ましく、耐熱性、耐マイグレーション性、吸湿後の耐熱性等に優れたものが得られた。更には、熱硬化性樹脂組成物中に絶縁性無機充填剤を配合することにより、炭酸ガスレーザー孔あけにおいて、未添加の場合に比して孔壁を均質にあけることができ、より孔の接続信頼性に優れたプリント配線板を作成することができる

【0009】

【発明の実施の形態】本発明は、両面処理銅箔付きBステージ樹脂シート、及びこのBステージ樹脂シートを少なくとも外層銅箔に使用して得られる銅張板又は多層板に、直接銅箔の上に炭酸ガスレーザーをパルス発振で照射し、孔径80～180μmの貫通孔及び／又はブラインドビア孔をあける等の工程を経て作成されるプリント配線板を提供する。孔あけ加工されたプリント配線板は、主に半導体チップの搭載用として使用される。孔あけ後、表裏及び内層の銅箔のバリが発生するが、この場合、高圧でエッチング液を吹き付けるか、吸引して孔内を通し、内外層の銅箔のバリを溶解除去する。その後、定法にて全体を銅メッキし、回路形成等を行ってプリント配線板を作成する。

【0010】本発明で使用する銅張板を作成するのに必要な両面処理銅箔とは、シャイニー面に炭酸ガスレーザーエネルギーを直接照射して孔あけ可能なエネルギーの吸収の良好な金属又は合金処理を施した銅箔である。炭酸ガスレーザーでの孔あけを容易にするためには、好適には、少なくともシャイニー面にニッケル金属処理或いはニッケル合金処理を施した両面処理銅箔が使用される。ニッケル処理或いはニッケル合金処理を施した面とは反対側の、銅張板の樹脂と接着するマット面は、一般に公知の銅張板用処理を施したものを使用する。もちろん、ニッケル金属処理、ニッケル合金処理も含まれる。この樹脂側の銅箔面には数μmの凹凸がある。又、この両面処理銅箔のニッケル金属処理或いはニッケル合金処理を施した面は、凹凸があっても無くても良い。両面処理銅箔の銅箔の厚みは、好適には厚さ3～12μmの電解銅箔の両面を処理したものが使用される。圧延銅箔も使用できる。内層板の銅箔としては厚さ9～18μmが好適に使用される。

【0011】本発明で使用する銅張板は、少なくとも1層以上の銅の層が存在する銅張板、多層板であり、基材補強されたもの、フィルム基材のもの、補強基材の無い樹脂単独のもの等が使用可能である。しかしながら、寸法収縮等の点からガラス布基材銅張板が好ましい。又、高密度の回路を作成する場合、表層の銅箔は、最初から薄いものを使用できるが、好適には、9～12μmの厚い銅箔を積層成形しておいて、炭酸ガスレーザーなどで孔加工後、表層の銅箔をエッチング液で2～7μm、好適には3～5μmまで薄くしたものを使用する。

【0012】本発明の両面処理銅箔付きBステージ樹脂シートは、好適には積層成形時に銅箔側に離型フィルム又は銅箔を配置し、その外側にステンレス板を使用して、加熱、加圧、好ましくは真空下に積層成形し、片面銅張板、両面銅張板とする。又、内層板を使用し、必要により銅箔表面に化学処理を施し、その外側に両面処理銅箔付き樹脂シートを配置し、積層成形する。積層成形後に加工方法によっては保護シートを剥離して孔あけする。もちろん、連続的に内層板に加熱、加圧下に貼り付け、その後、硬化する方法等も使用できる。

【0013】内層板に使用する銅張板の基材としては、一般に公知の、有機、無機の織布、不織布が使用できる。具体的には、無機の繊維としては、E、S、D、Mガラス等の繊維等が挙げられる。又、有機繊維としては、全芳香族ポリアミド、液晶ポリエステル、ポリベンザゾールの繊維等が挙げられる。これらは、混抄でも良い。ポリイミドフィルム等のフィルム類も使用可能である。

【0014】本発明で使用される両面銅箔付き樹脂シートの樹脂としては、一般に公知の熱硬化性樹脂が使用される。具体的には、エポキシ樹脂、多官能性シアン酸エステル樹脂、多官能性マレイミドーシアン酸エステル樹脂、多官能性マレイミド樹脂、不飽和基含有ポリフェニレンエーテル樹脂等が挙げられ、1種或いは2種類以上が組み合わせて使用される。出力の高い炭酸ガスレーザー照射による加工でのスルーホール形状の点からは、ガラス転移温度が150℃以上の熱硬化性樹脂組成物が好ましく、耐湿性、耐マイグレーション性、吸湿後の電気的特性等の点から多官能性シアン酸エステル樹脂組成物が好適である。内層板に使用する樹脂も同様である。

【0015】本発明の好適な熱硬化性樹脂分である多官能性シアン酸エステル化合物とは、分子内に2個以上のシアナト基を有する化合物である。具体的に例示すると、1,3-又は1,4-ジシアナトベンゼン、1,3,5-トリシア

ナトベンゼン、1,3-、1,4-、1,6-、1,8-、2,6-又は2,7-ジシアナトナフタレン、1,3,6-トリシアナトナフタレン、4,4-ジシアナトビフェニル、ビス(4-ジシアナトフェニル)メタン、2,2-ビス(4-シアナトフェニル)プロパン、2,2-ビス(3,5-ジブロモ-4-シアナトフェニル)プロパン、ビス(4-シアナトフェニル)エーテル、ビス(4-シアナトフェニル)チオエーテル、ビス(4-シアナトフェニル)スルホン、トリス(4-シアナトフェニル)ホスファイト、トリス(4-シアナトフェニル)ホスフェート、およびノボラックとハロゲン化シアンとの反応により得られるシアネート類などである。

【００１６】これらのほかに特公昭41-1928、同43-18468、同44-4791、同45-11712、同46-41112、同47-26853及び特開昭51-63149号公報等に記載の多官能性シアン酸エステル化合物類も用いられ得る。また、これら多官能性シアン酸エステル化合物のシアナト基の三量化によって形成されるトリアジン環を有する分子量400～6,000のプレポリマーが使用される。このプレポリマーは、上記の多官能性シアン酸エステルモノマーを、例えば鉱酸、ルイス酸等の酸類;ナトリウムアルコラート等、第三級アミン類等の塩基;炭酸ナトリウム等の塩類等を触媒として重合させることにより得られる。このプレポリマー中には一部未反応のモノマーも含まれており、モノマーとプレポリマーとの混合物の形態をしており、このような原料は本発明の用途に好適に使用される。一般には可溶な有機溶剤に溶解させて使用する。

【００１７】エポキシ樹脂としては、一般に公知のものが使用できる。具体的には、液状或いは固形のビスフェノールA型エポキシ樹脂、ビスフェノールF型エポキシ樹脂、フェノールノボラック型エポキシ樹脂、クレゾールノボラック型エポキシ樹脂、脂環式エポキシ樹脂、ブタジエン、ペンタジエン、ビニルシクロヘキセン、ジシクロペンチルエーテル等の二重結合をエポキシ化したポリエポキシ化合物類;ポリオール、水酸基含有シリコン樹脂類とエポハロヒドリンとの反応によって得られるポリグリシジル化合物類等が挙げられる。これらは1種或いは2種類以上が組み合わせて使用され得る。

【００１８】ポリイミド樹脂としては、一般に公知のものが使用され得る。具体的には、多官能性マレイミド類とポリアミン類との反応物、特公昭57-005406 に記載の末端三重結合のポリイミド類が挙げられる。これらの熱硬化性樹脂は、単独でも使用されるが、特性のバランスを考え、適宜組み合わせて使用するのが良い。

【００１９】本発明の熱硬化性樹脂組成物には、組成物本来の特性が損なわれない範囲で、所望に応じて種々の添加物を配合することができる。これらの添加物としては、不飽和ポリエステル等の重合性二重結合含有モノマー類及びそのプレポリマー類;ポリブタジエン、エポキシ化ブタジエン、マレイン化ブタジエン、ブタジエン-アクリロニトリル共重合体、ポリクロロプレン、ブタジエン-スチレン共重合体、ポリイソプレン、ブチルゴム、フッ素ゴム、天然ゴム等の低分子量液状～高分子量のelasticなゴム類;ポリエチレン、ポリプロピレン、ポリブテン、ポリ-4-メチルペンテン、ポリスチレン、AS樹脂、ABS樹脂、MBS樹脂、スチレン-イソプレンゴム、ポリエチレン-プロピレン共重合体、4-フッ化エチレン-6-フッ化エチレン共重合体類;ポリカーボネート、ポリフェニレンエーテル、ポリスルホン、ポリエステル、ポリフェニレンサルファイド等の高分子量プレポリマー若しくはオリゴマー;ポリウレタン等が例示され、適宜使用される。また、その他、公知の有機、無機の充填剤、染料、顔料、増粘剤、滑剤、消泡剤、分散剤、レベリング剤、光増感剤、難燃剤、光沢剤、重合禁止剤、チキソ性付与剤等の各種添加剤が、所望に応じて適宜組み合わせて用いられる。必要により、反応基を有する化合物は硬化剤、触媒が適宜配合される。

【００２０】本発明に使用する熱硬化性樹脂組成物の中に、絶縁性無機充填剤を添加できる。特に炭酸ガスレーザー孔あけ用としては、孔の形状を均質にするために10～80重量%、好ましくは、20～70重量%添加する。絶縁性無機充填剤の種類は特に限定はない。具体的には、タルク、焼成タルク、水酸化アルミニウム、カオリン、アルミナ、ウオラストナイト、合成雲母等が挙げられ、１種或いは２種以上を配合して使用する。

【００２１】熱硬化性樹脂組成物は、それ自体は加熱により硬化するが硬化速度が遅く、作業性、経済性等に劣る場合には、使用した熱硬化性樹脂に対して公知の熱硬化触媒を用い得る。使用量は、熱硬化性樹脂100重量部に対して0.005～10重量部、好ましくは0.01～5重量部である。

【００２２】本発明で使用する銅箔は、両面を処理した銅箔が使用される。炭酸ガスレーザーの照射面側であるシャイニー面には炭酸ガスレーザーエネルギーの吸収率が良き金属処理又は合金処理を行ったものを使用する。好適には、ニッケル金属処理或いはニッケル合金処理を施す。ニッケル処理は、ニッケル蒸着、ニッケルメッキ等、一般に公知のものが使用できる。ニッケル合金処理は、一般に公知のものが使用可能である。例えば、ニッケルとコバルトの合金、ニッケル-クロム-鉄の合金処理等が挙げられる。もちろん一般のコバルト処理、亜鉛処理等の中で炭酸ガスレーザーで孔あけ可能な処理は使用できる。反対側の樹脂と接着させる銅箔のマット面処理としては、一般に公知の銅張板用処理が使用される。この処理は、もちろんニッケル金属処理、ニッケル合金処理であっても良い。

【００２３】炭酸ガスレーザーの波長は、9.3～10.6μmが使用される。エネルギーは、好適には10～60mJで、所定パルス照射して孔あけする。貫通孔及び／又はブラインドビア孔をあける場合、最初から最後まで同一エネルギーを照射して孔あけする方法、エネルギーを途中で高

くするか、低くして孔あけする方法、いずれの方法でも良い。

【００２４】本発明の炭酸ガスレーザーでの孔あけにおいて、孔周囲に銅箔のバリが発生する。孔部に発生した銅箔のバリをエッチング除去する方法としては、特に限定しないが、例えば、特開平02-22887、同02-22896、同02-25089、同02-25090、同02-59337、同02-60189、同02-166789、同03-25995、同03-60183、同03-94491、同04-199592、同04-263488号公報で開示された、薬品で金属表面を溶解除去する方法（ＳＵＥＰ法と呼ぶ）による。エッチング速度は、一般には0.02～1.0μm/秒で行う。また、内層の銅箔バリをエッチング除去する場合、同時に銅箔の表面の一部をもエッチング除去し、厚さ２～７μm、好適には３～５μmとすることにより、その後の銅メッキされた銅箔に細密なパターンを形成でき、高密度のプリント配線板とすることができる。

【００２５】銅張板の裏面には、孔が貫通した場合のレーザーによるレーザーマシーンのテーブルの損傷を防ぐために、単に金属板を配置することも可能であるが、好ましくは、金属板の表面の少なくとも一部を接着させた樹脂層を銅張板の裏面銅箔と接着させて配置し、貫通孔あけ後に金属板を剥離する。

【００２６】加工された孔内部の表層、内層銅箔の樹脂が接着していた面には1μm程度の樹脂層が銅箔表面に残存する場合が殆どである。この樹脂層を、エッチング前にデスミア処理等の一般に公知の処理で事前に除去が可能であるが、液が小径の孔内部に到達しない場合、内層の銅箔表面に残存する樹脂層の除去残が発生し、銅メッキとの接続不良になる場合がある。従って、より好適には、まず気相で孔内部を処理して樹脂の残存層を完全に除去し、次いで孔内部及び表裏の銅箔バリをエッチング除去する。

【００２７】気相処理としては一般に公知の処理が使用可能であるが、例えばプラズマ処理、低圧紫外線処理等が挙げられる。プラズマは、高周波電源により分子を部分的に励起し、電離させた低温プラズマを用いる。これは、イオンの衝撃を利用した高速の処理、ラジカル種による穏やかな処理が一般には使用され、処理ガスとして、反応性ガス、不活性ガスが使用される。反応性ガスとしては、主に酸素が使用され、科学的に用面処理をする。不活性ガスとしては、主にアルゴンガスを使用する。このアルゴンガス等を使用し、物理的な表面処理を行う。物理的な処理は、イオンの衝撃を利用して表面をクリーニングする。低紫外線は、波長が短い領域の紫外線であり、波長として、184.9nm、253.7nm がピークの短波長域の波長を照射し、樹脂層を分解除去する。

【００２８】孔内部は、通常の銅メッキを施すことも可能であるが、また銅メッキで孔内部を一部、好適には80容積%以上充填することもできる。孔あけにおいては、もちろんエキシマレーザー、YAGレーザー等の併用もできる。又、メカニカルドリルの併用も可能である。

【００２９】

【実施例】以下に実施例、比較例で本発明を具体的に説明する。尚、特に断らない限り、『部』は重量部を表す。

【００３０】実施例１

2,2-ビス(4-シアナトフェニル)プロパン900部、ビス(4-マレイミドフェニル)メタン100部を150℃に溶融させ、撹拌しながら4時間反応させ、プレポリマーを得た。これをメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解した。これにビスフェノールA型エポキシ樹脂(商品名:エピコート1001、油化シェルエポキシ<株>製)400部、クレゾールノボラック型エポキシ樹脂(商品名:ESCN-220F、住友化学工業<株>製)600部、フェノールノボラック型エポキシ樹脂（商品名：DEN439、ダウケミカル<株>製）500部を加え、均一に溶解混合した。更に触媒としてオクチル酸亜鉛0.4部を加え、溶解混合し、これに無機充填剤(商品名:焼成タルク、日本タルク<株>、平均粒子径4μm)2000部、及び黒色顔料8部を加え、均一撹拌混合してワニスAを得た。このワニスを厚さ100μmのガラス織布に含浸し150℃で乾燥して、ゲル化時間(at170℃)１０４秒、ガラス布の含有量が５１重量%のプリプレグ(プリプレグB)を作成した。

【００３１】一方、長さ1000m、厚さ１１μmの両面処理銅箔のシャイニー面にニッケル合金処理（<株>ジャパンエナージー、Y処理、LD箔とも言う）を１μm施した電解銅箔のニッケル合金処理とは反対面の樹脂を接着させる銅箔マット面上に上記ワニスAを、厚さ60μm、ゲル化時間45秒になるように連続的に塗布、乾燥しBステージ樹脂付きシートCを作成した。

【００３２】ここで、上記プリプレグBを用い、12μmの一般電解銅箔をプリプレグB2枚の両側に配置し、200℃、20kgf/cm²、30mmHg以下の条件で積層成形して両面銅張積層板Dを得た。この両面銅張積層板Dの両面に回路を形成し、黒色酸化銅処理を施した後、その両面に両面処理銅箔付きＢステージ樹脂シートＣを、樹脂面が内層板側を向くように置き、その外側に1.5mm厚のステンレス板を配置し、これを繰り返して、熱盤間に15セット入れ、200℃、20kgf/cm²、30mmHg以下の真空下で2時間積層成形し、両面銅張多層板Eを得た。一方、ポリビニルアルコールを水に溶解した樹脂を厚み50μmのアルミニウム箔の片面に塗布し、110℃で20分乾燥して、厚さ20μmの塗膜を有するバックアップシートFを作成した。

【００３３】多層板Eの下側にバックアップシートFを置き、上側の銅箔の上から径100μmの孔を50mm角内に900個直接炭酸ガスレーザーで、パルス発振で出力10mJ で3ショット、20mJで3ショット照射して70ブロック、合計６３、０００個の貫通孔をあけた。又、13mJで２ショット照射し、孔径100μmのブラインドビア孔をあけた。

【００３４】下側のバックアップシートを除去し、プラ

ズマ装置の中に入れて処理した後、ＳＵＥＰ液を高速で吹き付けて、表裏の孔部に発生した銅箔バリを溶解除去すると同時に、表層の銅箔を4μmまで溶解した。デスミア処理後、銅メッキを15μm付着させた後、既存の方法にて回路(ライン/スペース＝50/50μm)、ハンダボールパッド等を形成し、少なくとも半導体チップ部、ボンディング用パッド部、ハンダボールパッド部を除いてメッキレジストで被覆し、ニッケル、金メッキを施し、プリント配線板を作成した。このプリント配線板の評価結果を表1に示す。

【００３５】実施例２エポキシ樹脂（商品名：エピコート1001、油化シェルエポキシ<株>製> 300部、及びエポキシ樹脂（商品名：ESCN220F、住友化学工業<株>製）700部、ジシアンジアミド35部、2-エチル-4-メチルイミダゾール1部をメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解し、均一に撹拌混合してワニスとした。このワニスを厚さ100μmのガラス織布に含浸、乾燥して、ゲル化時間150秒、ガラス布の含有量48重量%のプリプレグGを作成した。

【００３６】一方、幅540mm、厚み9μmの両面処理銅箔のシャイニー面にニッケル金属処理を施した銅箔の反対側のマット面にワニスFを厚さ50μmとなるように連続的に塗布、乾燥して、ゲル化時間55秒のＢステージ樹脂付きシートＨを得た。530x530mmのプリプレグＧを1枚使用し、上下に12μmの一般電解銅箔を置き、190℃、20kgf/cm²、30mmHgで積層成形し、両面銅張積層板Ｉを得た。この板の表裏に回路を形成後、黒色酸化銅処理を施した後、上下に両面処理銅箔付きＢステージ樹脂シートＨを540x540mmに切断したものを各１枚置き、加熱、加圧下に同様に積層成形して４層板Ｊとした後、この下側にバックアップシートＦを配置し、銅箔の上から炭酸ガスレーザーの出力15mJで２ショット、20mJで2ショット照射して貫通孔をあけた。

【００３７】更に炭酸ガスレーザーの出力12mJにて2ショット照射してビア孔をあけた。バックアップシートＦを除去後、全体をSUEP処理を施して表裏の銅箔厚さを3μmまで溶解除去した後、過マンガン酸カリウム水溶液にてデスミア処理を行なって、同様に銅メッキを行い、同様にプリント配線板とした。評価結果を表１に示す。

【００３８】比較例１

実施例１の多層板において、表層の銅箔を一般の電解銅箔（<株>ジャパンエナージー、JTC-LP箔）を用い、その他は実施例１と同様にして作成した４層板の表面に何も施すことに実施例１と同一条件で炭酸ガスレーザーで孔＊あけを行なったが、孔はあかなかった。

【００３９】比較例２

比較例１の多層板の表面に黒色酸化銅処理を施し、その後この表面を布で１０回擦って処理を研削し、この上から実施例１と同一条件で炭酸ガスレーザーを照射したが、孔はほとんどあかなかった。

【００４０】比較例３

エポキシ樹脂（商品名：エピコート5045)2,000部、ジシアンジアミド70部、2ーエチルイミダゾール2部をメチルエチルケトンとジメチルホルムアミドの混合溶剤に溶解し、更に実施例１の絶縁性無機充填剤を800部加え、撹拌混合して均一分散してワニスＫを得た。これを厚さ100μmのガラス織布に含浸、乾燥して、ゲル化時間140秒（at170℃），ガラス含有量52重量%のプリプレグL、ゲル化間180秒、厚さ50μmのガラス織布を使用しガラス含有量35重量%のプリプレグMを得た。このプリプレグLを2枚使用し、両面に12μmの電解銅箔を置き、180℃、20kgf/cm²、30mmHg以下の真空下で2時間積層成形して両面銅張積層板Nを得た。この積層板Nの両面に回路を形成し、黒色酸化銅処理後、その両面にプリプレグMを各1枚置き、その外側に12μmの一般銅箔を配置し、同様に積層成形して４層板Oとした。これを用い、メカニカルドリルで同様に孔あけして貫通孔を形成した。炭酸ガスレーザーでは直接照射してもビア孔はあかなかった。SUEP処理を行わず銅メッキを施し、同様にプリント配線板とした。評価結果を表１に示す。

【００４１】比較例４

実施例２の両面銅張板Ｉを用い、内層のスルーホールとなる箇所の銅箔を孔径100μmとなるように上下銅箔をエッチング除去し、回路を形成した後、銅箔表面を黒色酸化銅処理して、その外側にＢステージ樹脂シートＨの銅箔として一般の電解銅箔を用いたシートを各１枚置き、実施例２同様に積層成形して４層板を作成した。この多層板を用い、貫通孔を形成する表面の位置に孔径100μmの孔を900個、銅箔をエッチングしてあけた。同様に裏面にも同じ位置に孔径100μmの孔を900個エッチングしてあけた。１パターン900個を70ブロック、合計63,000の孔を、表面から炭酸ガスレーザーで、出力15mJにて3ショットかけ、スルーホール用貫通孔をあけた。後は比較例３と同様にして、SUEP処理を行わずに、デスミア処理を１回施し、銅メッキを15μm施し、表裏に回路を形成し、同様にプリント配線板を作成した。評価結果を表１に示す。

【００４２】

表1

項　　目	実施例		比較例		
	1	2	2	3	4
貫通孔形成（%）	100	100	9	100	100
表裏面ランド銅箔との隙間(μm)	0	0	—	0	27
内層との孔位置のズレ（μm）	—	0	—	0	39

パターン切れ及びショート（個）	0/200	0/200	—	52/200	53/200
ガラス転移温度（℃）	235	160	235	139	160
スルーホール・ヒートサイクル試験（%）					
100 サイクル	1.4	1.5	—	1.6	4.2
300 サイクル	1.7	1.9	—	1.8	9.6
孔あけ加工時間（分）	19	14	—	630	—
耐マイグレーション性(HAST)(Ω)					
常態	$5x10^{11}$	—	—	$1x10^{11}$	—
200hrs.	$6x10^{8}$			$< 10^{8}$	
500hrs.	$5x10^{8}$			—	
700hrs.	$3x10^{8}$				
1000hrs.	$2x10^{8}$				

【００４３】<測定方法>
1)表裏孔位置の隙間及び貫通孔の形成数
孔径100μm（炭酸ガスレーザー）又は150μm（メカニカルドリル）の孔を900孔/ブロック として70ブロック（孔計63,000孔）作成した。炭酸ガスレーザー及びメカニカルドリルで孔あけを行ない、１枚の銅張板に63,000孔をあけるに要した時間、及び表裏ランド用銅箔と孔との隙間、及び内層銅箔のズレの最大値を示した。
2)回路パターン切れ、及びショート
実施例、比較例で、孔のあいていない板を同様に作成し、ライン/スペース＝50/50μm の櫛形パターンを作成した後、拡大鏡でエッチング後の200パターンを目視にて観察し、パターン切れ、及びショートしているパターンの合計を分子に示した。
3)ガラス転移温度
ＤＭＡ法にて測定した。
4)スルーホール・ヒートサイクル試験
各スルーホール孔に直径250μmのランドを作成し、900孔を表裏交互につなぎ、1サイクルが、260℃・ハンダ・浸せき30秒→室温・5分 で、300サイクルまで実施し、抵抗値の変化率の最大値を示した。
5)耐マイグレーション性(HAST)
孔径100μm（炭酸ガスレーザー）又は150μm（メカニカルドリリング）の銅メッキされた貫通孔をそれぞれ表裏交互に１個ずつ計50個つなぎ、このつないだもの２組が孔壁間150μmで平行になるようにして、合計100セット作成し、130℃、85%RH、1.8VDC にて所定時間処理後に、取り出し、平行に配列した貫通孔間の絶縁抵抗値を＊測定した。

【００４４】
【発明の効果】本発明は、両面処理箔において、銅箔のシャイニー面に炭酸ガスレーザーエネルギーを直接照射して孔あけ可能な金属処理、好適には、少なくともシャイニー面にニッケル金属処理或いはニッケル合金処理を施した銅箔の、ニッケル金属処理或いはニッケル合金処理を施した面とは反対の銅箔マット面にＢステージの熱硬化性樹脂層を形成した樹脂シートを提供する。これを用いて積層成形した銅張板は、炭酸ガスレーザー孔あけ性能に優れ、銅箔の上から直接レーザービームを照射して貫通孔及び／又はブラインドビア孔を形成することが可能である。炭酸ガスレーザー孔あけは、メカニカルドリリングに比べて格段に加工速度が速く、生産性について大幅に改善でき、又、その後、孔部に発生した銅箔バリを溶解除去すると同時に、銅箔の表面の一部を溶解し、2〜7μm、好ましくは3〜5μmとすることにより、その後の銅メッキによるメッキアップにおいても、細密パターンを形成することができ、高密度のプリント配線板を作成することができる。加えて、絶縁性無機充填剤を添加することにより、孔形状が良好となる。表裏銅箔にエッチングして孔をあけ、ついで炭酸ガスレーザーで孔をあける場合に比して表裏用ランド銅箔と孔との隙間が生じない。加えて熱硬化性樹脂組成物として多官能性シアン酸エステル化合物、該シアン酸エステルプレポリマーを必須成分とする樹脂組成物を使用することにより得られたプリント配線板は、耐熱性、耐マイグレーション性等に優れたものが得られる。

【手続補正書】
【提出日】平成１２年8月１７日（２０００．８．１７）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】請求項1
【補正方法】変更
【補正内容】
【請求項１】　炭酸ガスレーザーエネルギー吸収の良い金属又は合金処理を銅箔シャイニー面に施した両面処理銅箔のマット面に、Ｂステージの樹脂層を付着させたことを特徴とする両面処理銅箔付きＢステージ樹脂シート。

フロントページの続き

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(54) B-STAGE RESIN SHEET WITH DOUBLE-SURFACE TREATED COPPER FOIL SUITABLE FOR CARBON DIOXIDE LASER PERFORATION, AND PRINTED WIRING BOARD USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a B-stage resin sheet with a copper foil which can be perforated by the direct irradiation with carbon dioxide laser.
SOLUTION: A sheet wherein a B-stage resin layer, which is obtained by applying a polyfunctional cyanic ester resin composition preferably compounded with 10-80 pts.wt. of an inorganic insulating filler to the opposite surface of a double-surface treated copper foil to which nickel treatment or nickel alloy treatment is preferably applied to dry the coating layer, is bonded on carbon dioxide laser irradiation side and the printed wiring board using this sheet are provided. The surface of the copper foil preferably subjected to nickel treatment or nickel alloy treatment of the copper clad sheet obtained using the sheet is directly irradiated with high output carbon dioxide laser of which the energy is preferably 10-60 mJ to process and remove outer and inner copper foil layers to form through-holes and/or blind viaholes with a pore size of 80-180 μm. Thereafter, the burr generated on the upper and rear surfaces of the copper foil and the inner copper layer and a part of the surface layer of the copper foil is removed by etching to adjust the thickness of the copper clad sheet to 2-7 μm. The copper clad sheet obtained by performing copper plating is used to form a high density printed wiring board. The B-stage resin sheet with the double-surface treated copper foil to which through-holes and/or blind viaholes can be formed by the direct irradiation with carbon dioxide laser can be obtained.

LEGAL STATUS
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* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] B stage resin sheet with double-sided processing copper foil characterized by making the resin layer of B stage adhere to the mat side of the double-sided processing copper foil which performed the good metal of carbon-dioxide-laser energy absorption, or alloy processing to the copper foil mat side.
[Claim 2] B stage resin sheet with double-sided processing copper foil according to claim 1 with which copper-foil face processing of a shy knee side is characterized by being [of this double-sided processing copper foil] nickel metalizing or nickel-alloy processing at least.
[Claim 3] B stage resin sheet with double-sided processing copper foil according to claim 1 or 2 this double-sided processing copper foil of whose is an electrolytic copper foil.
[Claim 4] B stage resin sheet according to claim 1, 2, or 3 with which this B stage resin sheet with double-sided processing copper foil is characterized by being a continuation sheet.
[Claim 5] The claims 1, 2, and 3 characterized by the resin of this B stage resin sheet being the thermosetting resin constituent which uses polyfunctional cyanic-acid ester and this cyanic-acid ester prepolymer as an indispensable component, or B stage resin sheet with double-sided processing copper foil given in four.
[Claim 6] The claims 1, 2, 3, and 4 characterized by blending an insulating inorganic bulking agent with this thermosetting resin constituent ten to 80% of the weight, or B stage resin sheet with double-sided processing copper foil given in five.
[Claim 7] the carbon dioxide laser of sufficient energy to carry out perforation processing of the upper shell copper foil of the copper-clad sheet by which has arranged B stage resin sheet with double-sided processing copper foil according to claim 1 at least on one side of an inner strake, and laminate molding was carried out to the bottom of heating and pressurization -- direct -- irradiating -- a breakthrough and/or blind beer -- the printed wired board characterized by forming a hole and being created
[Claim 8] the carbon dioxide laser of sufficient energy to carry out perforation processing of the upper shell copper foil of the copper-clad sheet hardened [has arranged the continuation B stage resin sheet with double-sided processing copper foil according to claim 4 at least on one side of an inner strake, heated and pressurized continuously, was made to paste up, and] and created -- direct -- irradiating -- a breakthrough and/or blind beer -- the printed wired board characterized by forming a hole and being created
[Claim 9] a carbon dioxide laser -- after perforation and a hole -- the printed wired board according to claim 7 or 8 characterized by dissolving a part of surface copper foil, and being created at the same time it carries out dissolution removal of the copper foil barricade generated on the outskirts with a medical fluid

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the high-density printed wired board which opened the hole of a minor diameter in the copper-clad sheet created using B stage resin sheet with double-sided processing copper foil, and it by the carbon dioxide laser. The obtained printed wired board is used as a small and lightweight semiconductor plastic package, a mother board printed wired board, etc.
[0002]
[Description of the Prior Art] Conventionally, that to which surface copper foil performed surface treatment in the high-density printed wired board used for a semiconductor plastic package etc. was not used. Moreover, in perforation processing, the breakthrough had ended with the mechanical drill. When the path of a drill turned into a minor diameter increasingly in recent years, and the aperture had become below 0.15mmphi and opened the hole of such a minor diameter, for the narrow reason, the diameter of a drill was the thing at which a drill turns at the time of perforation and which has a fault, like breaking and a working speed is slow, and has a problem in productivity, reliability, etc. blind beer -- the hole formed the hole by the carbon dioxide laser of low energy, after carrying out etching removal of the copper foil of the position which carries out perforation in advance This process required time, in order that lamination adhesion of an etching film, exposure, development, etching, a film ablation process, etc. might enter, and there was a problem in workability etc.
[0003] moreover -- if the hole of the same size is beforehand opened in the copper foil of the front reverse side by the predetermined method using the negative film, what formed beforehand the still more nearly same hole also as the copper foil of a inner layer by etching is arranged and it is going to form the hole which penetrates the front reverse side by the carbon dioxide laser The crevice was produced between position gap of inner layer copper foil and the hole and the up-and-down land, and there was a fault of being unable to form the land of a faulty connection and the front reverse side. Furthermore, in the printed wired board which carries out densification increasingly in recent years, thermal resistance, migration-proof nature, the insulation after moisture absorption, etc. are becoming a problem.
[0004]
[Problem(s) to be Solved by the Invention] this invention aims at offer of the printed wired board using the copper-clad sheet created using B stage resin sheet and this resin sheet which can solve the above trouble.
[0005]
[Means for Solving the Problem] this invention offers the printed wired board using the copper-clad sheet which created the resin layer of B stage using B stage resin sheet and it which are formed and obtained in the mat side of double-sided processing copper foil. it rivals [whether laminate molding is carried out using B stage resin sheet with double-sided processing ****, and] continuously -- making -- a copper-clad sheet -- carrying out -- this copper-clad sheet -- suitable -- a carbon dioxide laser -- a direct copper foil top -- a laser beam -- irradiating -- a breakthrough and/or blind beer -- a high-density printed wired board can be created by opening a hole and considering as a printed wired board
[0006] moreover, the thing for which a carbon dioxide laser is suitably irradiated directly in the perforation in the case of creating a printed wired board at nickel metalizing or the copper-foil face which carried out nickel-alloy processing -- a breakthrough and/or blind beer -- while it is possible to open a hole easily and being able to save time, such as carrying out etching removal of the copper foil in advance, the hole of a minor diameter can create efficiently at high speed the carbon dioxide laser of the energy preferably chosen from 10-60mJ in the output of a carbon dioxide laser -- upper shell irradiation of direct copper foil -- carrying out -- the breakthrough for through holes, and/or blind beer -- a hole is formed In a pore, the barricade of copper foil occurs after processing. Although a barricade can also be taken by mechanical polish, etching by the medical fluid from points, such as a dimensional change, is suitable. namely, -- or it sprays a medical fluid after perforation -- drawing in -- a hole -- etching removal also of the copper foil barricade is carried out at the same time it carries out etching removal of a part of copper foil of through and a surface for inside
[0007] the double-sided copper-clad sheet obtained by carrying out the plating rise of this with copper coating -- using -- the front reverse side -- circuit formation -- carrying out -- a law -- it considers as a printed wired board by the method In order to make the circuit of the front reverse side minute, 2-7 micrometers of copper foil of a front lining are preferably set to 3-5 micrometers. In this case, there is also no poor generating of short-circuit, a pattern piece, etc., and a high-density printed wired board can be created. furthermore, the working speed was alike and quick compared with the case where it opens with a

drill, productivity was also good, and the thing excellent also in economical efficiency was obtained
[0008] Moreover, it was desirable to have used the thermosetting resin constituent which uses polyfunctional cyanic-acid ester and this cyanic-acid ester prepolymer as an indispensable component as an insulating layer of a copper-clad sheet, and the thing excellent in thermal resistance, migration-proof nature, the thermal resistance after moisture absorption, etc. was obtained. Furthermore, by blending an insulating inorganic bulking agent into a thermosetting resin constituent, in carbon-dioxide-laser perforation, as compared with the case of not adding, a porous wall can be opened homogeneously, and the printed wired board which was more excellent in the connection reliability of a hole can be created. [0009]
[Embodiments of the Invention] the copper-clad sheet or multilayer board with which this invention is obtained by outer layer copper foil, using B stage resin sheet with double-sided processing copper foil, and this B stage resin sheet at least -- a direct copper foil top -- a carbon dioxide laser -- a pulse oscillation -- irradiating -- the breakthrough of 80-180 micrometers of apertures, and/or blind beer -- pass processes, such as opening a hole, -- the printed wired board created is offered The printed wired board by which perforation processing was carried out is mainly used as an object for loading of a semiconductor chip. although the barricade of the copper foil of the front reverse side and a inner layer occurs after perforation, or it sprays an etching reagent by high pressure in this case -- drawing in -- a hole -- dissolution removal of the barricade of the copper foil of through and an inside-and-outside layer is carried out for inside then, a law -- copper coating of the whole is carried out by the method, circuit formation etc. is performed, and a printed wired board is created
[0010] Double-sided processing copper foil required to create the copper-clad sheet used by this invention is copper foil which irradiated carbon-dioxide-laser energy directly in the shy knee side, and performed the good metal of absorption of the energy in which perforation is possible, or alloy processing. In order to make perforation in a carbon dioxide laser easy, the double-sided processing copper foil which performed nickel metalizing or nickel-alloy processing is suitably used for a shy knee side at least. With the field which performed nickel processing or nickel-alloy processing, what generally performed well-known processing for copper-clad sheets is used for the resin of a copper-clad sheet of an opposite side, and the mat side to paste up. Of course, nickel metalizing and nickel-alloy processing are also included. There is irregularity of several micrometers in the copper-foil face by the side of this resin. Moreover, even if the field which performed nickel metalizing of this double-sided processing copper foil] or nickel-alloy processing is irregular, there may be. [no] That to which the thickness of the copper foil of double-sided processing copper foil processed both sides of an electrolytic copper foil with a thickness of 3-12 micrometers suitably is used. Rolling copper foil can also be used. As copper foil of an inner strake, 9-18 micrometers in thickness are used suitably.
[0011] The copper-clad sheet used by this invention is the copper-clad sheet and multilayer board with which the layer of the copper of at least one or more layers exists, and that by which base-material reinforcement was carried out, the thing of a film base material, its thing resin independent [without a reinforcement base material], etc. are usable. However, points, such as size contraction, to a glass fabric base-material copper-clad sheet is desirable. moreover -- although a thin thing can be used for surface copper foil from the beginning when creating a high-density circuit -- suitable -- 9-12-micrometer thick copper foil -- laminate molding -- carrying out -- a carbon dioxide laser etc. -- a hole -- what made thin suitably 2-7 micrometers of surface copper foil to 3-5 micrometers by the etching reagent is used after processing
[0012] B stage resin sheet with double-sided processing copper foil of this invention -- suitable -- the time of laminate molding -- a copper foil side -- a mold release film or copper foil -- arranging -- the outside -- a stainless steel board -- using it -- heating and pressurization -- laminate molding is preferably carried out to the bottom of a vacuum, and it considers as an one side copper-clad sheet and a double-sided copper-clad sheet Moreover, an inner strake is used, a chemical treatment is performed to a copper foil front face as occasion demands, and laminate molding of the resin sheet with double-sided processing copper foil is arranged and carried out to the outside. After laminate molding, depending on the processing method, it exfoliates and perforation of the protection sheet is carried out. Of course, it sticks on the bottom of heating and pressurization continuously at an inner strake, and the method of hardening etc. can be used after that.
[0013] Generally as a base material of the copper-clad sheet used for an inner strake, organic [well-known] and well-known inorganic textile fabrics, and a nonwoven fabric can be used. Specifically as inorganic fiber, fiber, such as E, S, D, and M glass, etc. is mentioned. Moreover, as organic fiber, the fiber of all aromatic polyamides, liquid crystal polyester, and polybenzazole etc. is mentioned. Mixing is sufficient as these. Films, such as a polyimide film, are usable.
[0014] Generally as a resin of the resin sheet with double-sided copper foil used by this invention, well-known thermosetting resin is used. Specifically, an epoxy resin, a polyfunctional cyanic-acid ester resin, a polyfunctional maleimide cyanic-acid ester resin, a polyfunctional maleimide resin, an unsaturation machine content polyphenylene-ether resin, etc. are mentioned, and they are used by one sort or two kinds or more, combining. From the point of the through hole configuration in processing by high carbon-dioxide-laser irradiation of an output, a thermosetting resin constituent 150 degrees C or more has a desirable glass transition temperature, and a polyfunctional cyanic-acid ester-resin constituent is suitable from points, such as moisture resistance, migration-proof nature, and an electrical property after moisture absorption. The same is said of the resin used for an inner strake.
[0015] The polyfunctional cyanic-acid ester compound with a suitable this invention which is a part for thermosetting resin is a compound which has two or more cyanate groups in a molecule. When it illustrates concretely, 1 and 3- or 1, 4-JISHIANATO benzene, 1 and 3, 5-TORISHIANATO benzene, 1, 3-, 1, 4, -, 1, 6-, 1, 8, -, 2, 6- or 2, 7-JISHIANATO naphthalene, 1, 3, 6-TORISHIANATO naphthalene, 4, and 4-JISHIANATOBI phenyl, Screw (4-JISHIANATO phenyl) methane, 2, and 2-screw (4-cyanate phenyl) propane, 2 and 2-screw (3, 5-dibromo 4-cyanate phenyl) propane, The screw

(4-cyanate phenyl) ether, a screw (4-cyanate phenyl) thioether, It is cyanate obtained by the reaction of a screw (4-cyanate phenyl) sulfone, tris (4-cyanate phenyl) phosphite, tris (4-cyanate phenyl) phosphate, and a novolak and halogenation cyanogen.

[0016] these -- others -- JP,41-1928,B -- said -- 43-18468 -- said -- 44-4791 -- said -- 45-11712 -- said -- 46-41112 -- said -- the polyfunctional cyanic-acid ester compounds of a publication may be used for 47-26853, JP,51-63149,A, etc. Moreover, the prepolymer of the molecular weight 400-6,000 which has the triazine ring formed of 3 quantification of the cyanate group of these polyfunctional cyanic-acid ester compound is used. the polyfunctional cyanic-acid ester monomer of the above [this prepolymer] -- for example, acids, such as a mineral acid and a Lewis acid, --; sodium alcoholate etc. is obtained by carrying out a polymerization, using salts [, such as a base; sodium carbonate,], such as tertiary amines, etc. as a catalyst In this prepolymer, the unreacted monomer is also contained in part, the gestalt of the mixture of a monomer and a prepolymer is carried out, and such a raw material is used suitable for the use of this invention. It is used making it dissolve in the meltable organic solvent generally.

[0017] Generally as an epoxy resin, a well-known thing can be used. The poly epoxy compounds which specifically epoxidated double bonds, such as the liquefied or solid bisphenol A type epoxy resin, a bisphenol female mold epoxy resin, a phenol novolak type epoxy resin, a cresol novolak type epoxy resin, a cycloaliphatic epoxy resin, a butadiene, a pentadiene, a vinyl cyclohexene, and the JISHIKURO pentyl ether; the poly glycidyl compounds obtained by the reaction with a polyol, hydroxyl-group content silicon resin, and EPOHAROHI drine compounds are mentioned. These may be used by one sort or two kinds or more, combining them.

[0018] Generally as polyimide resin, a well-known thing may be used. Specifically, the reactant of polyfunctional maleimide and polyamine and the polyimides of an end triple bond given in JP,57-005406,B are mentioned. Although it is used even when these thermosetting resin is independent, it is good to use it, considering the balance of a property and combining suitably.

[0019] According to a request, various additives can be blended with the thermosetting resin constituent of this invention in the range by which the property of constituent original is not spoiled. As these additives, polymerization nature double bond content monomers, such as a unsaturated polyester, and the prepolymers; polybutadiene of those, An epoxidation butadiene, a mallein-ized butadiene, a Butadiene Acrylonitrile, A polychloroprene, a Butadiene Styrene, a polyisoprene, Rubber elastic in the amounts of low-molecular-weight liquefied - macromolecules, such as isobutylene isoprene rubber, a fluororubber, and natural rubber; Polyethylene, Polypropylene, a polybutene, a Polly 4-methyl pentene, polystyrene, An AS resin, ABS plastics, a MBS resin, styrene-polyisoprene rubber, a polyethylene-propylene copolymer, 4-fluoride [ethylene]-6-fluoride [ethylene] copolymers; the amount prepolymers of macromolecules, such as a polycarbonate, a polyphenylene ether, a polysulfone, polyester, and polyphenylene sulfide, or oligomer; polyurethane is illustrated, and it is used suitably. Moreover, in addition to this, according to a request, various additives, such as organic [well-known], an inorganic bulking agent, a color, a pigment, a thickener, lubricant, a defoaming agent, a dispersant, a leveling agent, a photosensitizer, a flame retarder, a brightener, a polymerization inhibitor, and a thixotropy grant agent, combine suitably, and are used. As for the compound which has a reaction machine, a curing agent and a catalyst are suitably blended by the need.

[0020] An insulating inorganic bulking agent can be added in the thermosetting resin constituent used for this invention. Especially as an object for carbon-dioxide-laser perforation, in order to make the configuration of a hole homogeneous, it adds 20 to 70% of the weight preferably ten to 80% of the weight. Especially limitation does not have the kind of insulating inorganic bulking agent. Specifically, talc, baking talc, an aluminum hydroxide, a kaolin, an alumina, a wollastonite, a synthetic mica, etc. are mentioned, and it is used, blending one sort or two sorts or more.

[0021] In itself, although a thermosetting resin constituent is hardened by heating, its cure rate is slow, and when inferior to workability, economical efficiency, etc., a well-known heat-curing catalyst can be used for it to the used thermosetting resin. the amount used -- the thermosetting resin 100 weight section -- receiving -- 0.005 - 10 weight section -- it is 0.01 - 5 weight section preferably

[0022] The copper foil to which the copper foil used by this invention processed both sides is used. The absorption coefficient of carbon-dioxide-laser energy uses what performed good metalizing or alloy processing for the shy knee side which is the irradiation side side of a carbon dioxide laser. Suitably, nickel metalizing or nickel-alloy processing is performed. Generally nickel processing can use a well-known thing for nickel vacuum evaporationo, nickel plating, etc. Generally nickel-alloy processing has a well-known usable thing. For example, the alloy of nickel and cobalt, alloy processing of a nickel-ferrochromium, etc. are mentioned. Of course, the processing in which perforation is possible at a carbon dioxide laser can be used in general cobalt processing, zinc processing, etc. Generally as mat side processing of the resin of an opposite side, and the copper foil made to paste, the well-known processing for copper-clad sheets is used. Of course, this processing may be nickel metalizing and nickel-alloy processing.

[0023] As for the wavelength of a carbon dioxide laser, 9.3-10.6 micrometers is used. Suitably, energy is 10-60mJ, and predetermined pulse irradiation of it is carried out, and it carries out perforation. a breakthrough and/or blind beer -- the method and energy which irradiate the same energy and carry out perforation from the beginning to the last when opening a hole -- on the way -- the method of coming out of and making high, or making low and carrying out perforation and which method may be used

[0024] the perforation in the carbon dioxide laser of this invention -- setting -- a hole -- the barricade of copper foil occurs around As a method of carrying out etching removal of the barricade of the copper foil generated in the pore Although not

limited especially, for example JP,02-22887,A -- said -- 02-22896 -- said -- 02-25089 -- said -- 02-25090 -- said -- 02-59337 -- said -- 02-60189 -- said -- 02-166789 -- said -- 03-25995 -- said -- 03-60183 -- said -- 03-94491 -- said -- 04-199592 -- It is based on the method (it is called the SUEP method) of carrying out dissolution removal of the surface of metal with a chemical by which it was indicated in the 04-263488 official report. Generally an etch rate is performed in a second in 0.02-1.0micrometers /. Moreover, when carrying out etching removal of the copper foil barricade of a inner layer, by carrying out etching removal of a part of front face of copper foil simultaneously, and 3-5 micrometers costing 2-7 micrometers in thickness suitably, a minute pattern can be formed in the copper foil to which copper coating of after that was carried out, and it can consider as a high-density printed wired board.

[0025] Although it is also possible to only arrange a metal plate in order to prevent damage on the table of the laser machine by laser when a hole penetrates in the rear face of a copper-clad sheet, preferably, the resin layer on which a part of front face [at least] of a metal plate was pasted up is pasted up with the rear-face copper foil of a copper-clad sheet, it arranges, and a metal plate is exfoliated after penetration perforation.

[0026] the processed hole -- the case where an about 1-micrometer resin layer remains on a copper foil front face almost comes out to the field which the internal surface and the resin of inner layer copper foil had pasted up although this resin layer is removable in advance by well-known processing generally [DESUMIA processing etc.] before etching -- liquid -- the hole of a minor diameter -- when not arriving at the interior, ****** of the resin layer which remains on the copper foil front face of a inner layer may occur, and it may become a faulty connection with copper coating therefore -- more -- suitable -- first -- a gaseous phase -- a hole -- the interior -- processing -- the residual layer of a resin -- perfect -- removing -- subsequently -- a hole -- etching removal of the copper foil barricade of the interior and the front reverse side is carried out

[0027] Although well-known processing is generally usable as gaseous-phase processing, plasma treatment, low voltage ultraviolet-rays processing, etc. are mentioned, for example. Plasma excites a molecule partially by the RF generator, and the low-temperature plasma made to ionize is used for it. Generally the high-speed processing for which this used the shock of ion, and the moderate processing by the radical kind are used, and reactant gas and inert gas are used as a raw gas. As reactant gas, oxygen is mainly used and **** processing is carried out scientifically. As inert gas, argon gas is mainly used. This argon gas etc. is used and physical surface treatment is performed. Physical processing cleans a front face using the shock of ion. Wavelength is the ultraviolet rays of a short field and low ultraviolet rays are 184.9nm and 253.7nm as wavelength. The wavelength of the short wavelength region of a peak is irradiated and decomposition removal of the resin layer is carried out.

[0028] a hole -- although the interior can also perform the usual copper coating -- moreover, copper coating -- a hole -- it can also be suitably filled up with a part of interior more than 80 capacity % Of course in perforation, combined use of an excimer laser, an YAG laser, etc. can also be performed. Moreover, combined use of a mechanical drill is also possible.

[0029]

[Example] An example and the example of comparison explain this invention concretely below. In addition, unless it refuses especially, the "section" expresses the weight section.

[0030] It was made to react for 4 hours, having carried out melting of an example 12, the 2-screw (4-cyanate phenyl) propane 900 section, and the screw (4-maleimide phenyl) methane 100 section to 150 degrees C, and agitating them, and the prepolymer was obtained. This was dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide. The bisphenol A type epoxy resin (tradename : Epicoat 1001, product made from oil-ized shell epoxy <stock>) 400 section, the cresol novolak type epoxy resin (tradename : ESCN- 220 F, product made from the Sumitomo Chemical <stock>) 600 section, and the phenol novolak type epoxy resin (tradename : DEN439, product made from the Dow Chemical <stock>) 500 section were added to this, and dissolution mixture was carried out uniformly. Furthermore, the octylic acid zinc 0.4 section was added as a catalyst, dissolution mixture was carried out, the inorganic bulking agent (tradename : baking talc, Japanese talc <stock>, 4 micrometers of mean particle diameters) 2000 section and the black-pigment 8 section were added to this, uniform churning mixture was carried out, and Varnish A was obtained. It sank into the glass cloth with a thickness of 100 micrometers, this varnish was dried at 150 degrees C, and the content of a glass fabric created 51% of the weight of the prepreg (prepreg B) for gelation-time (at170 degree C) 104 seconds.

[0031] On the other hand, it is nickel-alloy processing (it is also called <stock> Japan Energy, Y processing, and LD foil) to the shy knee side of double-sided processing copper foil with a length [of 1000m], and a thickness of 11 micrometers. With nickel-alloy processing of the electrolytic copper foil given 1 micrometer, on the copper foil mat side on which the resin of an opposite side is pasted up, continuously, it applied and the above-mentioned varnish A was dried, as it had been 60-micrometer [in thickness], and gelation-time 45 seconds, and the sheet C with B stage resin was created.

[0032] Here, using the above-mentioned prepreg B, the 12-micrometer general electrolytic copper foil has been arranged on prepreg B2 sheet both sides, laminate molding was carried out on 200 degrees C, 20 kgf/cm2, and the conditions of 30 or less mmHgs, and the double-sided copper clad laminate D was obtained. After forming a circuit in both sides of this double-sided copper clad laminate D and performing black copper-oxide processing, a resin side should turn [both sides / the] B stage resin sheet C with double-sided processing copper foil to an inner strake side. It placed, the stainless steel board of 1.5mm ** has been arranged on the outside, this was repeated, 15 sets were put in between heating plates, laminate molding was carried out for 2 hours under 200 degrees C, 20 kgf/cm2, and the vacuum of 30 or less mmHgs, and the double-sided copper-clad multilayer board E was obtained. On the other hand, the resin which dissolved polyvinyl alcohol in water was applied to one side of an aluminum foil with a thickness of 50 micrometers, it dried at 110 degrees C for 20 minutes, and the backup sheet E which has a paint film with a thickness of 20 micrometers was created.

[0033] The backup sheet F is put on the multilayer board E bottom, and it is output 10mJ by pulse oscillation at a 900-piece direct carbon dioxide laser in 50mm angle about the hole of 100 micrometers of diameters of an upper shell of upper copper foil. Three shots irradiated by three shots and 20mJ, and 70 blocks and a total of 63,000 breakthroughs were opened. moreover, 13mJ -- two shots -- irradiating -- blind beer of 100 micrometers of apertures -- the hole was opened
[0034] The lower backup sheet was removed, and after putting in into plasma equipment and processing, SUEP liquid was sprayed at high speed, and while carrying out dissolution removal of the copper foil barricade generated in the pore of the front reverse side, surface copper foil was dissolved to 4 micrometers. After DESUMIA processing, after making 15 micrometers of copper coating adhere, the circuit (a line / space =50 / 50 micrometers), the pewter ball pad, etc. were formed by the existing method, it covered with the plating resist except for the semiconductor chip section, the pad section for bondings, and the pewter ball pad section at least, nickel and gold plate were performed, and the printed wired board was created. The evaluation result of this printed wired board is shown in Table 1.
[0035] example 2 epoxy resin (tradename: -- Epicoat 1001, the oil-ized shell epoxy <product made from stock >> 300 section and the epoxy resin (tradename : ESCN220 F, product made from the Sumitomo Chemical <stock>) 700 section, the dicyandiamide 35 section, and the 2-ethyl-4-methyl imidazole 1 section were dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide, stirring mixture was carried out uniformly, and it considered as the varnish) This varnish was sunk in and dried to the glass cloth with a thickness of 100 micrometers, and the prepreg G of 48 % of the weight of contents of a glass fabric was created for gelation-time 150 seconds.
[0036] On the other hand, to the mat side of the opposite side of copper foil which performed nickel metalizing to the shy knee side of double-sided processing copper foil with a width of face [of 540mm], and a thickness of 9 micrometers, continuously, it applied and Varnish F was dried so that it might become 50 micrometers in thickness, and the sheet H with B stage resin for gelation-time 55 seconds was obtained. One 530x530mm prepreg G was used, the 12-micrometer general electrolytic copper foil was placed up and down, laminate molding was carried out by 190 degrees C, 20 kgf/cm2, and 30mmHg, and the double-sided copper clad laminate I was obtained. After forming a circuit in the front reverse side of this board, carry out laminate molding of what cut B stage resin sheet H with double-sided processing copper foil to 540x540mm up and down like the bottom of each [every other] sheet, heating, and pressurization after performing black copper-oxide processing. After considering as four lamellaes J, the backup sheet F has been arranged to this down side, two shots irradiated by two shots and 20mJ by output 15mJ of the upper shell carbon dioxide laser of copper foil, and the breakthrough was opened.
[0037] furthermore, output 12mJ of a carbon dioxide laser -- two shots -- irradiating -- beer -- the hole was opened DESUMIA processing was performed in potassium permanganate solution, copper coating was performed similarly, and the removal back was similarly considered as the printed wired board, after having performed the backup sheet F, performing SUEP processing for the whole and carrying out dissolution removal of the copper foil thickness of the front reverse side to 3 micrometers. An evaluation result is shown in Table 1.
[0038] In the multilayer board of example of comparison 1 example 1, others should make surface copper foil be the same as that of an example 1 using a general electrolytic copper foil (<stock> Japan Energy, JTC-LP foil). Although the carbon dioxide laser performed hole <TXF FR=0002 HE=220 WI=080 LX=1100 LY=0300> **** on the same conditions as an example 1, without adhering anything to the front face of four created lamellaes, the hole did not open.
[0039] Although black copper-oxide processing was performed to the front face of the multilayer board of the example 1 of example of comparison 2 comparison, this front face was ground against cloth 10 times after that, the grinding of the processing was carried out and the carbon dioxide laser was irradiated on the same conditions as an example 1 from on this, a hole hardly opened.
[0040] The example of comparison 3 epoxy-resin (tradename : Epicoat 5045) 2,000 section, the dicyandiamide 70 section, and the 2-ethyl imidazole 2 section were dissolved in the partially aromatic solvent of a methyl ethyl ketone and a dimethylformamide, further, stirring mixture was carried out 800 ******s, uniform distribution of the insulating inorganic bulking agent of an example 1 was carried out, and Varnish K was obtained. This was sunk in and dried to the glass cloth with a thickness of 100 micrometers, and the prepreg M of 35 % of the weight of glass contents was obtained for gelation-time 140 seconds (at170 degree C) using the glass cloth with a thickness of 50 micrometers for the prepreg L of 52 % of the weight of glass contents, and 180 seconds between gelling. Two sheets of this prepreg L were used, the 12-micrometer electrolytic copper foil was put on both sides, laminate molding was carried out for 2 hours under 180 degrees C, 20 kgf/cm2, and the vacuum of 30 or less mmHgs, and the double-sided copper clad laminate N was obtained. The circuit was formed in both sides of this laminate N, Prepreg M has been arranged to the both sides after black copper-oxide processing, 12-micrometer general copper foil has been arranged on each [every other] sheet and its outside, laminate molding was carried out similarly, and it considered as four lamellaes O. Using this, perforation was similarly carried out with the mechanical drill, and the breakthrough was formed. even if it irradiates directly in a carbon dioxide laser -- beer -- the hole did not open SUEP processing was not performed, but copper coating was performed, and it considered as the printed wired board similarly. An evaluation result is shown in Table 1.
[0041] After having carried out etching removal of the vertical copper foil so that it might become 100 micrometers of apertures about the copper foil of the part used as the through hole of a inner layer using the double-sided copper-clad sheet I of example of comparison 4 example 2, and forming a circuit, black copper-oxide processing of the copper foil front face was carried out, laminate molding of the sheet which used the electrolytic copper foil general as copper foil of B stage resin sheet

H for the outside was carried out like each [every other] sheet and the example 2, and four lamellaes were created. Using this multilayer board, 900 pieces and copper foil were **********ed in the position of the front face which forms a breakthrough, and the hole of 100 micrometers of apertures was opened in it. Similarly, 900 pieces **********ed in the same position also as a rear face, and the hole of 100 micrometers of apertures was opened in it. One patterns [900] were covered by 70 blocks, three shots of a total of 63,000 holes were covered by output 15mJ by the carbon dioxide laser from the front face, and the breakthrough for through holes was opened. Like the example 3 of comparison, without performing SUEP processing, the rest performed DESUMIA processing once, performed 15 micrometers of copper coating, formed the circuit in the front reverse side, and created the printed wired board similarly. An evaluation result is shown in Table 1.
[0042]
Table 1 Term Eye . Fruit ** Example Ratio ** Example 1 2 2 3 4 breakthrough formation (%) 100 100 9 100 Crevice between 100 table rear-face land copper foil (micrometer) 0 0 - 0 Gap of a hole location with 27 inner layers (micrometer) - 0-0 39 pattern pieces and short-circuit (individual) 0/200 0/200 - 52/200 53 / 200 glass transition temperatures (degree C) 235 160 235 139 160 through-hole thermo-cycle examination (%)
100 Cycle 1.4 1.5 - 1.6 4.2 300 Cycle 1.7 1.9 - 1.8 9.6 Perforation Floor to Floor Time (Minute) 19 14 - 630 Migration-proof [-] Nature (HAST) (Omega)
Ordinary state 5x1011. - - 1x1011 - 200hrs(es). 6x108 < 108 500hrs(es). 5x108 - 700hrs. 3x108 1000hrs. 2x108. [0043] It is a /block 900 holes about the crevice between <measuring method> 1 front reverse side hole locations and the 100 micrometers (carbon dioxide laser) of the number apertures of formation of a breakthrough, and a 150 micrometers (mechanical drill) hole. 70-block (**** 63,000 hole) creation was carried out and carried out. The carbon dioxide laser and the mechanical drill performed perforation, and the time required for opening 63,000 holes, the crevice between the copper foil for front reverse side lands and a hole, and the maximum of gap of inner layer copper foil were shown in the copper-clad sheet of one sheet.
2) Create similarly the board with which a hole has not opened in the example of a circuit pattern piece and a short example, and comparison, and they are a line / space =50 / 50 micrometers. After creating the Kushigata pattern, 200 patterns after etching were visually observed with the magnifying glass, and the sum total of a pattern piece and a shorting pattern was shown in the molecule.
3) It measured by the glass-transition-temperature DMA method.
4) through hole thermo-cycle examination each through hole -- a hole -- a land with a diameter of 250 micrometers -- creating -- 900 holes -- front reverse side alternation -- tying -- 1 cycle -- 260 degree C, a pewter, a dipping 30-second -> room temperature, and 5 minutes It carried out up to 300 cycle and the maximum of the rate of change of resistance was shown.
5) Connect 100 micrometers (carbon dioxide laser) of migration-proof nature (HAST) apertures, and the 150 micrometers (mechanical drilling) breakthrough by which copper coating was carried out a total of alternately [every one piece / 50] with the table reverse side, respectively, and 2 sets of this connected thing should become parallel by 150 micrometers between porous walls. A total of 100 sets are created and they are 130 degrees C, 85%RH, and 1.8VDC. It took out after predetermined-time processing and the insulating resistance between the breakthroughs arranged in parallel was measured.
[0044]
[Effect of the Invention] this invention offers the resin sheet in which the thermosetting resin layer of B stage was formed to the copper foil mat side opposite to the field which irradiated carbon-dioxide-laser energy directly in the shy knee side of copper foil, and performed suitably nickel metalizing or nickel-alloy processing of metalizing [in which perforation is possible], and the copper foil which performed nickel metalizing or nickel-alloy processing to the shy knee side at least, in a double-sided processing foil. the copper-clad sheet which carried out laminate molding using this -- a carbon-dioxide-laser perforation performance -- excelling -- the upper shell direct laser beam of copper foil -- irradiating -- a breakthrough and/or blind beer -- it is possible to form a hole boiling carbon-dioxide-laser perforation markedly compared with mechanical drilling, its working speed being quick and it being able to improve sharply about productivity, and dissolving a part of front face of copper foil after that, at the same time it carries out dissolution removal of the copper foil barricade generated in the pore, and setting 2-7 micrometers to 3-5 micrometers preferably Also in the plating rise by subsequent copper coating, a minute pattern can be formed and a high-density printed wired board can be created. in addition, the thing for which an insulating inorganic bulking agent is added -- a hole -- a configuration becomes good As compared with the case where ********** to front reverse side copper foil, open a hole, and a hole is subsequently opened by the carbon dioxide laser, the crevice between the land copper foil for the front reverse sides and a hole is not generated. In addition, that the printed wired board obtained by using a polyfunctional cyanic-acid ester compound and the resin constituent which uses this cyanic-acid ester prepolymer as an indispensable component as a thermosetting resin constituent excelled [that] in thermal resistance, migration-proof nature, etc. is obtained.

[Translation done.]

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DERWENT-WEEK: 200206

TITLE: Copper-clad board used for printed wiring board is obtained by disposing double-side-treated copper foil provided with metallic-treatment layer on outer layer of thermosetting resin composition layer

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BASIC-ABSTRACT:

NOVELTY - A copper-clad board is obtained by disposing a double-side-treated
copper foil with a metallic-treatment layer at least on an outer layer of a
thermosetting resin composition layer.

DETAILED DESCRIPTION - A copper-clad board for making a hole with a carbon

dioxide gas laser, is obtained by disposing a double-side-treated copper foil (b) provided with a metallic-treatment layer having a high absorption rate of carbon dioxide gas laser energy on a surface(s), at least on an outer layer of a thermosetting resin composition layer so that the metallic-treatment layer is formed on a shiny surface of the copper foil and the thermosetting resin composition layer under heat and pressure, to make an alloy of the metallic-treatment layer and the copper by the above heating. INDEPENDENT CLAIMS are also included for the following:

(A) a method of making a hole in a copper-clad board, in which the metallic-treatment layer surface of the copper-clad board is directly irradiated with a carbon dioxide gas laser having 5-60 mJ energy for processing a copper foil by pulse oscillation of the carbon dioxide gas laser, to make a penetration hole and/or a blind via hole;

(B) a printed wiring board which is prepared by directly irradiating a copper foil surface of the copper-clad board with a carbon dioxide gas laser having an energy of 10-60 mJ, to make a penetration hole and/or a blind via hole.

USE - The copper clad board with a hole is used as a printed wiring board.

ADVANTAGE - The copper-clad board is excellent in workability for making a hole, and is free from the occurrence of defective items with regard to a hole owing to the formation of a metallic-treatment layer which has a high absorption rate of a carbon dioxide gas laser energy and which causes no peelings by friction on a surface copper foil of the copper-clad board.

DESCRIPTION OF DRAWING(S) - The figure shows the copper clad board.

Protective sheet a

Copper foil b

CHOSEN-DRAWING: Dwg.1/6

TITLE-TERMS: COPPER CLAD BOARD PRINT WIRE BOARD OBTAIN DISPOSABLE DOUBLE SIDE
TREAT COPPER FOIL METALLIC TREAT LAYER OUTER LAYER THERMOSETTING
RESIN COMPOSITION LAYER

DERWENT-CLASS: A85 L03 P55 P73 V04

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